REMARKS

In the last Office Action, the Examiner rejected claims 1, 2, 6, 13 and 20 as being unpatentable over applicant's prior art disclosure in Figs. 9-11 ("APD") in view of U.S. Patent No. 6,050,665 to Kishi. Claims 3-5, 7-12 and 14-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over APD in view of Kishi and further in view of U.S. Patent No. 6,431,672 to Ardito et al. ("Ardito").

Summary of Arguments

Applicant respectfully traverses the prior art rejections of claims 1-20. As set forth in detail below, the combined teachings of APD and Kishi do not disclose or suggest the data storage means of the ink jet head and the setting means of the external circuit and corresponding functions of the data storage means and setting means recited in each of independent claims 1, 6 and 13. In this regard, neither the delay circuit (which stores only one type of driving information data) nor the ROM 49 (which stores only control programs for controlling drive and transport mechanisms) in Kishi stores two or more (claim 1) or a plurality (claims 6, 13) of different types of driving information data of the ink jet head, as required by independent claims 1, 6 and 13. Furthermore, the ROM 49 in Kishi is provided in a control unit side of the printer, not in an ink jet head, as required by each of independent claims 1, 6 and 13.

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Applicant therefore requests reconsideration of his application without further amendment to the claims as follows.

Brief Summary of the Invention

The present invention is directed to an ink jet recording apparatus.

Figs. 9-11 show a conventional ink jet recording apparatus. As described in the specification (pgs. 1-5), in the conventional ink jet recording apparatus an operation for managing and setting a voltage rank for each ink jet head is complicated and time consuming because it must be performed manually for each ink jet head. For example, when attaching the ink jet head to the ink jet recording apparatus, setting is performed manually while an operator checks the voltage rank written on a label attached to the ink jet head. The required manual operation also results in substantial instances of setting errors which degrades the printing operation of the ink jet recording apparatus.

Another drawback of the conventional ink jet recording apparatus is that it is difficult to promptly determine the cause of a malfunction or deterioration of the ink jet head. In this regard, it has been difficult for a user to judge whether the malfunction or deterioration is due to failure of the ink jet head or the expiration of its lifetime.

The present invention overcomes the drawbacks of the conventional art. Figs. 1-8 show an embodiment of an ink jet recording apparatus 10 according to the present invention embodied in the claims. The ink jet recording apparatus 10 has an ink jet head 20 comprised of a piezoelectric ceramic plate 30 having at least a pair of partition walls 34 with deformable side walls spaced apart at a preselected distance to form a channel 33 for receiving ink and communicating with a nozzle opening 32, and a pair of electrodes each connected to respective ones of the side walls of the partition walls 34. A wiring substrate 50 is mounted with a driving circuit 52 including a driving integrated circuit for applying a driving voltage to the pair of electrodes to deform the side walls of the partition walls 34 of the piezoelectric ceramic plate 30 to vary the volume of the channel 33 to thereby eject ink from the nozzle opening 32.

According to the present invention, the ink jet head 20 includes data storage means 100 for storing two or more different types of driving information data of the ink jet head including driving condition data. An external circuit 110 is connected to the driving circuit 52 of the ink jet head 20 and has setting means 140 for reading at least the driving condition data stored in the data storage means 100 and automatically setting driving conditions of the ink jet head 20 in accordance with the driving condition data.

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In one embodiment, the driving condition data stored in the data storage means 100 includes voltage rank data for setting to a predetermined value a magnitude of the driving voltage applied by the driving integrated circuit, and dot count data obtained by counting the number of times of ink discharge of the ink jet head 20.

By the foregoing construction of the ink jet recording apparatus according to the present invention, an operation for managing and setting driving conditions of the ink jet head is simplified as compared to the conventional art. For example, in the invention the setting means automatically sets the driving conditions (e.g., voltage rank) of the ink jet head. Thus, a time consuming setting operation of a voltage rank, for example, through manual input is not required during shipment or exchange of the ink jet head. Furthermore, setting errors due to manual input of information are eliminated.

Moreover, by storing dot count data of the ink jet head in the data storage means, the usage status of the ink jet head can be readily obtained to determine whether a deterioration in the ink discharge characteristic is due to failure or expiration of the lifetime of the ink jet head.

Traversal of Prior Art Rejections

Claims 1, 2, 6, 13 and 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over APD in view of Kishi. Applicant respectfully traverses this rejection and submits that the combined teachings of APD and Kishi do not disclose or suggest the subject matter recited in independent claims 1, 6 and 13 and dependent claims 2 and 20.

Each of independent claims 1, 6 and 13 is directed to an ink jet recording apparatus and requires an ink jet head having <u>data storage means for storing two or more (claim 1) or a plurality of (claims 6, 13) different types of driving information data of the ink jet head including driving condition data</u>, and an external circuit connected to the driving circuit of the ink jet head and having <u>setting means for reading at least the driving condition data stored in the data storage means and automatically setting driving conditions of the ink jet head in accordance with the driving condition data</u>. No corresponding structural and functional combination is disclosed or suggested by the prior art of record.

APD discloses an ink jet recording apparatus as described in the specification and reiterated herein. As recognized by the Examiner, APD does <u>not</u> disclose or suggest the data storage means of the ink jet head and the setting means of the external circuit and corresponding functions of

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the data storage means and setting means recited in each of independent claims 1, 6 and 13.

The secondary reference to Kishi discloses a printer including a system for automatically adjusting the drive voltage of a print head according to a predetermined rank characteristic of the print head. The rank characteristic (i.e., driving condition data) is stored in a delay circuit connected to a driver IC 26 of a print head 2 (Fig. 6).

Thus in Kishi the delay circuit functions as data storage means for storing a driving condition (i.e., rank characteristic) of the print head. However, the delay circuit of Kishi does <u>not</u> constitute data storage means <u>for storing two or more (claim 1) or a plurality of (claims 6, 13) different types of driving information data</u> of the ink jet head, as recited in independent claim 1. Stated otherwise, the delay circuit in Kishi stores <u>only one type</u> of driving information data (i.e., rank characteristic).

In the final Office Action, the Examiner contends that the data storage means and corresponding function recited in claims 1, 6 and 13 corresponds to the disclosure in Kishi of a CPU 43 connected to a ROM 49 "for storing a variety of printing data types." Applicant respectfully disagrees.

First, the ROM 49 in Kishi is provided in <u>a control unit side</u> of the printer, <u>not</u> in <u>an ink jet head</u>, as required by each of independent claims 1, 6 and 13. Furthermore, the

ROM 49 in Kishi stores control programs for controlling the drive mechanism of a carriage 3 and the transport mechanism for a recording medium P (col. 7, lines 2-5), not a variety of printing data types as the Examiner contends. In contrast, claims 1, 6 and 13 explicitly require that the function of the data storage means of the ink jet head is to store two or more (claim 1) or a plurality (claims 6, 13) of different types of driving information data including driving condition data of the ink jet head. The control programs stored by the ROM 49 of Kishi do not correspond to the different types of driving information data stored in the data storage means of claims 1, 6 and 13.

Moreover, unless the "data storage means" disclosed by Kishi performs the identical functions specified in independent claims 1, 6 and 13 it cannot be an equivalent for the purposes of Section 112, 6th paragraph. Pennwalt Corp. v. Durand-Wayland, Inc., 4 USPQ2d 1737 (Fed. Cir. 1987). In this regard, there is no teaching or suggestion in Kishi of "data storage means for storing two or more (claim 1) or a plurality (claims 6, 13) of different types of driving information data of the ink jet head", as recited in independent claims 1, 6 and 13. Again, neither the delay circuit (which stores only one type of driving information data) nor the ROM 49 (which stores only control programs for controlling drive and

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transport mechanisms) in Kishi stores two or more (claim 1) or a plurality (claims 6, 13) of different types of driving information data of the ink jet head, as required by the independent claims.

Moreover, Kishi does not disclose or suggest the setting means and corresponding functions recited in independent claims 1, 6 and 13, including the functions of reading at least <u>the driving condition data stored in the data storage means</u> and automatically setting driving conditions of the ink jet head <u>in accordance with the driving condition data</u>.

Accordingly, the combination of features required by independent claims 1, 6 and 13 are not taught or suggested by the combined teachings of APD and Kishi and, therefore, one ordinarily skilled in the art would not have been led to modify the Kishi in view of APD to attain the claimed subject matter. <u>See</u>, <u>inter</u> <u>alia</u>, <u>In re Fine</u>, 5 USPQ2d 1596, 1598, (Fed. Cir. 1988), and <u>Uniroyal, Inc. v. Rudkin-Wiley Corp.</u>, 5 USPQ2d 1434, 1439 (Fed. Cir. 1988), <u>cert. denied</u>.

Claims 2 and 20 depend on and contain all of the limitations of independent claims 1 and 13, respectively, and, therefore, distinguish from the references at least in the same manner as claims 1 and 13.

In view of the foregoing, applicant respectfully requests that the rejection of claims 1, 2, 6, 13 and 20 under 35 U.S.C. §103(a) as being unpatentable over APD in view of Kishi be withdrawn.

Claims 3-5, 7-12 and 14-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over APD in view of Kishi and further in view of Ardito. Applicant respectfully traverses this rejection and submits that the combined teachings of APD, Kishi and Ardito do not disclose or suggest the subject matter recited in dependent claims 3-5, 7-12 and 14-19.

APD in view of Kishi does not disclose or suggest the subject matter recited in independent claims 1, 6 and 13 as set forth above for the rejection of claims 1, 2, 6, 13 and 20 under 35 U.S.C. §103(a). Claims 3-5, 7-12 and 14-19 depend on and contain all of the limitations of independent claims 1, 6 and 13, respectively, and, therefore, distinguish from the references at least in the same manner as claims 1, 6 and 13.

Moreover, there are separate grounds for patentability of dependent claims 3-5, 7-10 and 14-17.

Claims 3, 7, 10, 14 and 17 include the additional limitation that the driving information data stored in the data storage means includes dot count data obtained by counting the number of times of ink discharge of the ink jet

head. Claims 4, 8 and 15 include the additional limitation
that the ink jet recording apparatus further comprises data
writing means for storing the number of times of ink discharge
of the ink jet head <u>as the dot count data in the data storage
means</u>. Claims 5, 9 and 16 include the additional limitation
that the ink jet recording apparatus further comprises data
managing means for managing <u>the dot count data stored in the
data storage means</u>.

Thus each of dependent claims 3-5, 7-10 and 14-17
requires <u>dot count data as driving information data stored in
the data storage means of the print head</u>. The Examiner cited
Ardito for its disclosure of an ink jet printer capable of
counting ink drops that are fired by a print head. However,
Ardito does <u>not</u> disclose or suggest an ink jet head having
<u>data storage means for storing a plurality of types of driving
information data including dot count data</u>, as required by
independent claims 1, 6 and 13, from which claims 3-5, 7-10
and 14-17 respectively depend. Since Ardito does not disclose
or suggest these structural and functional features, it does
not cure the deficiencies of APD as modified by Kishi.
Accordingly, one of ordinary skill in the art would not have
been led to modify the references to attain the claimed
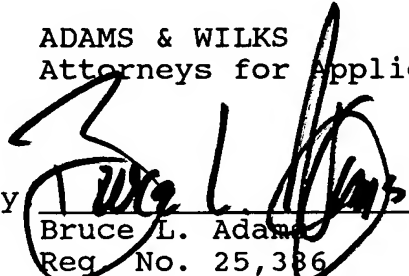subject matter.

In view of the foregoing, applicant respectfully requests that the rejection of claims 3-5, 7-12 and 14-19 under 35 U.S.C. §103(a) as being unpatentable over APD in view of Kishi and further in view of Ardito be withdrawn.

In view of the foregoing amendments and discussions, the application is now believed to be in allowable form. Accordingly, favorable reconsideration and passage of the application to issue are most respectfully requested.

Respectfully submitted,

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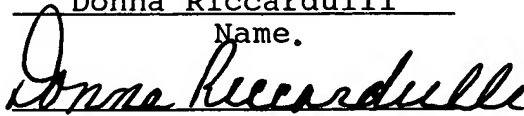
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